FAQ's for Actel's Antifuse FPGA Programming

Version 4.0

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I. Programmer- Installation and Setup

I.1. General

1. What programmers can I use to program Actel devices?

Ans. Actel only tests the programming of Actel devices on the FlashPro, Silicon Sculptor, and BP Microsystems programmers. Each release of the Silicon Sculptor and FlashPro software goes through a rigorous testing procedure to ensure the best programming yield possible. This test procedure includes programming devices and functionally testing these devices. The Activator programmer has been discontinued, and we no longer provide software updates.

Actel does not test programming solutions from any other vendors and cannot guarantee programming yield. Actel will accept Programming Failure RMAs up to the allowed fallout, but we reserve the right to reject any RMA requests if the fallout is excessive. We will not perform Failure Analysis on devices programmed by hardware from other vendors.

I.2. Activator

2. Is there a checklist to follow before programming with Activator?

Ans. If you are using Actel's Activator 2 or Activator 2S programmers to program an Actel FPGA, verify the following before executing any commands from the Windows programming software:

1. Activator 2 or (Activator 2S) is powered on and the green LED is on.
2. The appropriate adapter module(s) is plugged into the socket(s) on Activator.
3. A device is inserted in the adapter module, with pin 1 oriented as indicated in the diagram printed on the adapter module.

Note: Insert a device into the adapter module socket AFTER the module is plugged in and the Activator is powered up.

3. How can I verify that the software driver for the Activator (2/2S) is configured properly?

Ans. Double-click the devices icon located in the Control Panel program group. Look for the "Aspi32" driver. Its status should be **Started** and **Automatic**.

4. How do I configure the Adaptec AVA-1505A SCSI Card for Windows 95/98?

Ans. To configure the Adaptec AVA-1505 SCSI controller card for Windows 95, refer to the *Activator and APS Programming System - Installation and User's Guide* located at

http://www.actel.com/documents/ActivatorUG.pdf.

Once opened, go to "Installing the 1505A Card" under Windows 95/98, located in Chapter 2.

5. How do I configure the Adaptec AVA-1505 SCSI Card for Windows NT 4.0?

Ans. To configure the Adaptec AVA-1505 SCSI controller card for Windows NT 4.0, refer to the *Activator and APS Programming System - Installation and User's Guide* located at

http://www.actel.com/documents/ActivatorUG.pdf.

Once opened, go to "Installing the 1505A Card" under Windows 95/98, located in Chapter 2.

6. Can I use an existing Adaptec SCSI Controller on a PC?

Ans. You can only use an Adaptec SCSI controller card with Activator 2 or 2S. You cannot use any other manufacturer's SCSI card. You need to find an appropriate SCSI cable to match your board's external SCSI connector to the Activator 2 or 2S connector (female DB50 for Activator 2, DB25 for Activator 2S).

IMPORTANT: Activator 2 or 2S must be the last device in the SCSI chain, as Activator 2 and 2S contain termination resistors. If SCSI ID number 5 is not available on your SCSI bus, set the rotary switch on the back of your Activator 2 or 2S to an available SCSI ID and invoke the APSW programming software with an additional parameter, as described below. These examples assume that your Actel software is installed in the “c:\actel” directory, and that you want to use SCSI ID number 4. The following procedure is for Windows NT 4.0 or Windows 95.

1. From the main window, highlight the **Start** button with the right mouse button.
2. Select **Open All Users** (Open for Windows 95) > **Programs** > **Designer Series 3.1** click **Windows Programming**.
3. From the **File** menu, select **Properties** > **Shortcut** tab.
4. Append "devactivator2: <SCSI ID>" to the command line, as shown below:

C:\actel\bin\apsw.exe devactivator2:4

7. How can I determine what IRQ and I/O addresses are used by installed add-in cards?

Ans. Follow the instructions below:

1. Double-click the **Computer** icon. The **Computer Properties** window is displayed.
2. Click the **Interrupt Request (IRQ)** button to view the IRQ already in use.
3. Click the **Input/output (I/O)** button to view the I/O addresses already in use.

The default interrupt number is IRQ11, but can be set from IRQ9 to IRQ12. The default I/O address is 340h-35Fh but can be set to 140h-15Fh. For information about changing the I/O address on the 1505A card, refer to the “Jumper Block Settings” section in the Adaptec AVA-1505A AT-to-SCSI Host Adapter Installation Guide. If all the interrupts between IRQ9 and IRQ12 are being used, you must change the IRQ settings on another card to free one of these interrupts for the 1505A card.

8. The green power light is blinking after I turn on the power in Activator. What is the problem?

Ans. A self-test has failed. Contact Actel Technical Support at 1-800-262-1060 or tech.support@actel.com for assistance.

9. What does the error message “SCSI Controller not found” (PC only) mean?

Ans. The SCSI controller board has not been installed in the PC or there is a SCSI I/O address conflict. Also, verify that the device driver(s) were installed correctly. For more information, refer to the following GURU document located at:

http://www.actel.com/apps/guru/sep97/rp261.html

10. What does the error message “Firmware load failed. WARNING: Could Not Connect With Activator 2” mean?

Ans. This message is displayed by Actel's Windows Programming software when no contact with the programmer can be found. If this occurs, check that you have turned on the Activator 2/2S programmer and that the SCSI cable is correctly installed. Be especially sure that the SCSI cable connection is secure. The locking arms on the SCSI board can easily be misaligned. Also, verify that the device driver(s) were installed correctly. For more information, see the Activator and APS Programming System - Installation and User's Guide located at:

http://www.actel.com/documents/ActivatorUG.pdf

11. What does the message “Error: Activator communication link down. Exiting …” mean?

Ans. There is a problem with the connection between the Activator and the PC or the Activator has lost power. Check the connections (the Activator power light should be illuminated), and try re-invoking APSW. For more information, see the Activator and APS Programming System - Installation and User's Guide at:

http://www.actel.com/documents/ActivatorUG.pdf

12. How can I set up Aspi32 on WinNT and Windows 95/98/2000?

Ans. If you are using the Adaptec SCSI card and experiencing problems connecting to the Actel Programmer, follow the procedure described in the GURU document located at:

http://www.actel.com/apps/guru/mar98/ja1010.html

13. Is there any memory in the Actel Activator programmer?

Ans. No. The programming information is downloaded to the programmer during the programming of a device.

I.3. Silicon Sculptor I and II

14. Where can I find a list of the supported devices for the Silicon Sculptor programmer?

Ans. To check devices currently supported by Silicon Sculptor, visit:

http://www.actel.com/custsup/updates/silisculpt/device_list.html

15. Is there a checklist to follow before programming with Silicon Sculptor?

Ans. You need to check several things to start programming with Silicon Sculptor. You can find the checklist in the GURU document located at:

http://www.actel.com/apps/guru/feb00/ek2207.html

16. What is the Power-On Self-Test (POST) for Silicon Sculptor?

Ans. When power is applied to the Silicon Sculptor programmer, it performs a power-on self-test (POST). This test checks RAM, ROM, CPU, analog circuits, and basic system integrity.

Note: Do not attempt any programming operations until the POST is complete. If the POST fails, the red ERROR LED turns on.

Failure codes are:

- Three short flashes-- cannot self-calibrate
- Two short flashes -- ROM checksum error
- One short, one long flash-- RAM error

If you encounter any of these errors, contact Actel Technical Support at 1-800-262-1060 or tech.support@actel.com. Do not attempt to program any devices if self-test fails.

17. How many devices can I program successfully on a Silicon Sculptor adapter module?

Ans. The modules are rated for up to 10,000 insertions. The frequency of running the self-test is dependant upon usage.

18. Is there any memory in the Silicon Sculptor programmer?

Ans. Yes. The memory is used to broadcast the programming information in concurrent mode.

II. Adapter Modules

II.1. Activator

19. Where can I find a list of adapter module part numbers for Activator?

Ans. The adapter modules are device, package, and programmer specific. The list of modules for Activator is available at:

http://interact.actel.com/designtools/prgrmrs/modules.html

II.2. Silicon Sculptor I and II

20. Where can I find a list of adapter module part numbers for Silicon Sculptor?

Ans. The adapter modules are device, package, and programmer specific. The list of modules for Silicon Sculptor is available at:

http://interact.actel.com/designtools/prgrmrs/modules.html

21. Can I use the same module for different devices? For example, if I have an SM84P-ACTEL-1 module, can I use this to program an A1020B PL84 or an A3265DX PL84 device?

Ans. You can program the majority of Actel antifuse devices using the same package module on the Silicon Sculptor. However, some devices require a new revision or a different module for programming. For the appropriate module needed to program each Actel device, refer to the module list at:

http://interact.actel.com/designtools/prgrmrs/modules.html

22. Can I use Silicon Sculptor Adapter modules to program Actel devices with other BP programmers like BP1400, BP2100 etc?

Ans. Yes, Actel recommends using Silicon Sculptor adapter modules to program Actel devices with other BP programmers. However, you cannot use other BP Adapter modules to program Actel devices with Silicon Sculptor.

III. Diagnostic/Self-Test

III.1. Activator

23. How do I run the Activator 2 test Procedure?

Ans. You can run the diagnostic test for the Activator 2 and 2S. The procedure is described in the GURU document located at:

http://www.actel.com/apps/guru/mar98/hc1700.html

If you use the programmer occasionally, run the self-test before each programming. If you use the unit daily, test it once a week.

III.2. Silicon Sculptor I & II

24. How do I run a self-test in the DOS version of the Silicon Sculptor software?

Ans. The Silicon Sculptor programmer can test its own hardware quite extensively. You are strongly advised to run a full system self-test on the programmer before performing any other operation. The self-test routine can detect problems in the pin drivers, power supply, microprocessor, data cable, printer port, and several other circuits. To execute the test:

1. Remove any chips from the programmer sites. Any device left in a programmer site may be damaged during testing.
2. Press **Alt-D**.
3. Choose to test a single unit or all units.
4. Watch the screen for any error messages.

If you receive an error during the test, contact Actel Technical Support at 1-800-262-1060 or tech.support@actel.com for assistance.

25. How do I run a self-test in the Windows version of Silicon Sculptor?

Ans. To run the self-test on your device programmer, click the **Device** button, and select **Actel Diagnostics** from the list of available devices (type “diagnostics”). Once selected, the main window displays the **Actel Diagnostics** label in the **Device** field and a **Test File** tab appears.

To test the programmer, click the **Test** button. The **Test** dialog box verifies how many units you wish to test. Once you click **OK** to begin the test, a window appears to prompt you to verify that there is no chip in the socket. The test starts and runs until it is done or until you click the **Stop** button. If you decide to cancel the self-test, click the **Stop** button at any time during the procedure. A window will appear to acknowledge that the operation was aborted. To re-execute the test, simply click the **Test** button again. Your programmer should pass the test.

Verify by checking the green PASS LED on the chassis of the programmer. If your programmer does not pass the test, the red FAIL LED will be activated and the following error message will be displayed on-screen:

Error 47: Self-test failed. This unit may need service. Please call technical support.

If this happens, double-check the fidelity of the cable connections and try again. Make note of the exact error message and contact Actel Technical Support at 1-800-262-1060 or tech.support@actel.com for assistance if you are still having trouble.

26. The self-test failed for the BGA 329 Adapter module for Silicon Sculptor. Why?

Ans. The lid of the BGA 329 adapter module is made of metal. So when you run the self-test by keeping the lid closed, it may come in contact with the base of the socket, which is also made of metal. It will give you the "self test failed" result for this particular adapter module. It is recommended to run the self-test by keeping the lid open for this particular adapter module. If it still fails the self-test, contact Actel technical support for the replacement. You can run self-test for all other modules by closing the lids.

27. How frequently should I run the self-test?

Ans. You must ensure that all programming hardware is in good, working condition. This requires regular execution of the hardware self-diagnostic test and maintaining valid calibration of the programming hardware. Perform the self-diagnostic test before every programming session. At a minimum, execute the test every week.

IV. Calibration

IV.1. Activator

28. How frequently do I need to calibrate Actel Activators?

Ans. Actel Activators are calibrated before leaving the factory and should not require any further calibration during their lifetime. Actel provides a diagnostic utility (Activator Diagnostic Test) that you can run to guarantee that Activator is operating within the calibration specifications. Actel recommends that you run this diagnostic test on a schedule that coincides with your normal hardware calibration routine (typically once every six months). If you find their Activator “out of specification” after running the diagnostic tool, the unit must be calibrated.

29. How do I perform the calibration of Activator 2/2S?

Ans. Eagle performs the calibration for Actel. Contact Eagle if you would like your Activator 2/2S calibrated. Their telephone number is 408-748-1545.

IV.2. Silicon Sculptor I and II

30. How do I perform the calibration of Silicon Sculptor?

Ans. Calibration customers should contact BP Microsystems (1-800-225-2102 or tech@bpmicro.com). BP charges $75.00 and provides an approximate one week turnaround time. Alternatively, a calibration (# 48D) socket can be purchased from BP Microsystems for $250, which includes instructions on how to check the calibration.

During operation, each pin driver is continuously monitored and calibrated by a special supervisory circuit. The self-diagnostic test will verify correct operation of the pin drivers, power supply, CPU memory, and communications. It is necessary to verify the accuracy of the self-test to insure that it will provide accurate results. The programmer uses an internal Digital Volt Meter (DVM) to measure the voltage and/or current of 13 internal nodes and 48 analog pin drivers, allowing verification. Its accuracy may be verified with a bench DVM.

An option in the self-diagnostic test may be executed to allow testing of the accuracy of the internal DVM and time base using a bench DVM and oscilloscope or period counter. Actel recommends that the following procedure be performed every 12 months. The procedure may be performed in the field or at the factory for a charge. If the unit fails the accuracy or self-test, return it to the factory for repair and failure analysis.

Procedures for verifying accuracy of internal DVM

1. Secure the SM48D in place on the programmer (48 pin DIP socket module: this adapter module can only be bought from BP MICROSYSTEM 1-800-225-2102).
2. Press **ALT-D**.
3. Press the **T** key when prompted.
4. Connect the black lead of the DVM to Pin 3 of the DIP Socket.
5. Measure the voltage at pins 1 and 2 of DIP socket and check that they fall within the minimum and maximum levels displayed on the screen.
6. Press any key to continue.

Procedures for verifying AC calibration

1. Use an oscilloscope or period counter to verify that the positive pulse on pin one is between 890 us and 910 us.

The programmer will produce a 900 us pulse width on Pin 1 of the DIP socket. This completes the trace ability test. The programmer will continue with a self-test, and it must pass this test. Perform a self-test on each programming socket module that you use.

V. Concurrent Programming

V.1. Activator

31. What is the maximum number of Activator programmers that I can daisy chain together?

Ans. Activator programmers cannot be daisy-chained together.

V.2. Silicon Sculptor I and II

32. How do I setup Silicon Sculptor for concurrent programming?

Ans. Silicon Sculptor is a concurrent programmer, meaning that multiple sites can simultaneously program the same design. Your PC is used to hold the data that will be programmed into the devices. Specific programming algorithms and instructions are stored on the PC and downloaded to the programmer when you select a chip and load the buffer. Thus, the algorithm is actually executed by each programmer's internal microprocessor. This guarantees accurate waveforms and precisely controlled critical time delays independent of the PC's performance. The speed of your PC will only affect the rate at which the programming algorithm and data is downloaded to the programmer, not the programming yield. For more information on how to setup multiple Sculptors to facilitate concurrent programming, refer to the GURU document located at
http://www.actel.com/apps/guru/sep98/hw1675.html

33. What is the max number of Silicon Sculptor programmers that I can daisy chain together?

Ans. The maximum number of 6X programmers that can be daisy-chained together is two for 12 programming sites. Actel does not support more than four single site programmers connected together.

VI. Programming Software

VI.1. General

34. What software packages should I use to program Actel devices?

Ans. For Activator: APSW version R1-2000 or newer contains all the latest available programming algorithm updates. For Silicon Sculptor: Sculptor for DOS and SculptW for Windows. Check the Actel website for the latest version:

http://www.actel.com/custsup/updates/index.html

VI.2. Activator

35. Where can I get the APSW software?

Ans. APSW comes with the Actel Designer or Libero® Integrated Design Environment (IDE) software package. Contact your local sales representative to get the latest version of the software.

36. Does the programming software also work on HP/Solaris workstations?

Ans. APSW is available for HP and Solaris workstations, but the Silicon Sculptor software is only available for DOS or Windows.

37. How do I verify the functionality of a programmed device with the APSW debugger?

Ans. The Activator 2/2S can be used to verify functionality of an Actel FPGA (not available for SX and newer devices) by using special debugger software to stimulate inputs and to observe outputs and internal nodes. For complete information on how to invoke the debugger software and write verification commands, refer to the GURU document available at:

http://www.actel.com/apps/guru/jan00/rp235.html

38. What is the .avi/.txt file? When and where is it generated?

Ans. The .avi/.txt file is a generated log file when an Actel FPGA is programmed. The file contains information about the number of V_{PP} voltage pulses applied to each fuse to program the fuse and the programming current sensed through each fuse. If a programming failure occurs, the .avi/.txt file contains information about the programming failure mode. A new .avi/.txt file is generated each time the programming sequence begins. If you want to save an .avi/.txt file, you must rename it before restarting the programming sequence. You can find an example and explanation of an .avi file in the Activator and APS Programming System - Installation and User's Guide:

http://www.actel.com/documents/ActivatorUG.pdf

The .avi file is generated by Activator and the .txt file is generated by Sculptor. Silicon Sculptor generates the .txt file for RT and RH devices only. However, due to some limitations, it does not generate a .txt file for RTSX/RTSX-S devices.

39. After loading the .afm file successfully, why am I getting "Unable to open AFMBLANK file" when I click on Blankcheck in Activator?

Ans. Check if the file <family>.afm exists in the $ALSDIR/data/a<family>/<family>/<family>.afm directory. If the file does not exist, APSW gives this message. Please uninstall and reinstall the software to resolve this problem.

40. If I program four devices in the four sockets of the activator, will I get four different .avi files for four parts?

Ans. No. Actually you will get only one .avi file, but it will contain all the information of all four sockets.

VI.3. Sculptor

41. Where can I get the Silicon Sculptor software?

Ans. Silicon Sculptor for DOS and for Windows is available for download at:

http://www.actel.com/custsup/updates/silisculpt

42. How can I measure the programming time in Silicon Sculptor DOS?

Ans. While programming a device in Silicon Sculptor you can measure the elapsed time. To do this, select **ALT** + **F10** and select **ON** in the **Elapsed Time** window prior to starting programming.

43. How can I measure the programming time in Silicon Sculptor Windows?

Ans. To measure the elapsed time during a function in Silicon Sculptor Windows, go to the **Tools** menu, choose **Options**, and select **ON** in the **Elapsed Time** window.

44. Is the .avi/.txt file supported in Silicon Sculptor?

Ans. The .txt file is supported in Silicon Sculptor only for RT and RH devices. No .txt file is supported for RTSX/RTSX-S devices.

45. Why am I getting a five digit checksum (example: CSUM=7EA7C) under “Data Pattern” when I load an .afm file in the Silicon Sculptor Windows software?

Ans. This checksum is not related to an Actel device or an Actel .afm file. The BP software calculates internally, which gives the five digit checksum. There is no need to worry about this; it is not related to Actel.

46. In the Sculptor software under Device>Option, you will see two other options "secure after programming" and "secure after verifying". What is the difference between these two options?

Ans. Secure After Programming is the option we use for Actel devices. **Secure After Verifying** is something that is used for EPROM devices. BP uses the same interface for the Actel software and their own software. Selecting **Secure After Verifying** does not do anything to Actel devices. If you want automatic secure, use the **Secure After Programming** option.

47. What are the functions of the Blankcheck and Checksum commands in the software?

Ans. The **Blankcheck** button or menu command executes a test to determine if a device has already been programmed. Blankcheck displays a report for each socket that has an adapter module plugged into it. Blankcheck is performed automatically before the chip is programmed whenever the command is used. The result of executing Blankcheck is either “blank” or “not blank” followed by the silicon signature, checksum, and security fuse status read from the device. Only blank devices of the correct type (according to the design parameters) result in a blank status.

The **Checksum** button or menu command verifies that the current programming file is the same one you used to program the device. The **Checksum** command compares the checksum number, computed from the programming file, to the checksum number programmed into the chip. If the two numbers are the same, the program displays “PASSED.” If the two numbers are not the same, the program displays “FAILED,” with additional comments to briefly explain why it failed.

VII. Programming Files and Functions

VII.1. General

48. What files can I use to program a device?

Ans. See Table 1.

Table 1: Files for Programming

Activator	Silicon Sculptor
.adb or .afm file	.afm file

49. Can I still program with .def and .fus files on Activator?

Ans. Yes. You can still program Actel FPGAs with the .def and .fus files by using the appropriate method from the GURU document located at:
http://www.actel.com/apps/guru/jan00/hw1627.html

In the future, Actel will only support the .afm format.

50. Can I generate the .afm files from .def and .fus files?

Ans. Yes. It is possible to generate .afm files from .def and .fus files, but the procedure to do so depends on your version of the Actel software. Choose the procedure that corresponds to the software version you are running from the GURU document located at:

http://www.actel.com/apps/guru/nov02/zb3002.htm

51. How are the programming files generated?

Ans. The Designer software is used to generate the programming file. The **Fuse** button in the Designer software generates the .afm file. You can also generate the .afm file using the following path:
File > **Export** > **Fuse Files**.

52. Are .afm files that are generated by different versions of Designer compatible?

Ans. All the .afm files generated from Designer v3.0 and later are forward compatible. For example, an .afm file generated from Designer v3.0 can be used to program a part using Designer v3.1.1.

- For SX family devices: if the .afm file was generated using R1'99 Update One or earlier, you must regenerate a new .afm file with R1 '99 Update Two or newer. For A54SX72A devices, the .afm file should be generated using Designer R1-2001 SP4 or newer.
- For A42MX24 and A42MX36 devices: if the .afm file was generated using R1'99 Update One or earlier, you must regenerate the .afm file using R1'99 Update Two or newer.
- For ACT1 and 40MX family devices: Actel has experienced some issues with the .afm files generated using R1'99 Release and R1'99 Update One. To solve these issues, you must use R1'99 Update Two or newer.

Designs that are generated from Designer versions prior to v3.0 (that is, before the .afm file was introduced) are programmed using the .def and .fus files.

53. How do I check which version of Designer was used to create my .afm file?

Ans. Open the .afm file in a text editor. The header states the Designer release number that was used. The following example is an excerpt from an .afm file:

| PROGRAM Designer Series (tm) Development System

| VERSION R2-2001 Post-Prod 4.3.4.7

54. Can I use the same programming file with devices of different technologies?

Ans. If you generate a programming file with one technology, (for example, a1020A), but actually program a different technology of the same device (for example, an RH1020), there are risks that this operation will not be successful. Because of the differences in separate revisions of devices, there are variations in programming. They include the programming voltage level and length of time allowed before the device "times out," that might result in a programming failure. In addition, there are AC timing differences from one technology to the next. If proper simulation is not performed, the new device technology may not exhibit the same AC characteristics as the original. To avoid these issues, Actel recommends using the .afm files generated specifically for the device you want to program. See the **User Action** section below for more information.

User Action

Required: Whenever you change to a new device, you must update the design files to the targeted device type prior to programming the new device. This will ensure that the device receives the proper programming steps and settings.

Recommended: Actel recommends that you resimulate your designs for the new device type to ensure that all timing requirements are met.

Warranty: Actel does not provide any warranty for devices that are programmed with an incorrect device type file. Programming failures resulting from the device being programmed with the incorrect file types will not be accepted for replacement unless approved by Actel Technical Support.

55. Can I retarget to a compatible device with just an .afm file?

Ans. No. The .afm file for one technology cannot be used to program a device of another technology-even if the parts are compatible. In general, there is no way to regenerate any design database information from just the .afm file.

56. Can I use ACT 2 .afm files to program 1200XL devices?

Ans. While it is true that ACT 2 and 1200XL devices are pin-to-pin compatible, their .afm files are not the same. The primary difference between ACT 2 devices and 1200XL devices is the length of the register used for programming; 1200XL devices have a much longer register chain. To program a 1200XL device, you must regenerate the .afm file. Actel also recommends that you rerun timing and simulation since the 1200XL devices are faster.

Note: You may use ACT 2 .afm files to program “A” rev ACT 2 devices (i.e.1280 .afm file can program 1280A device) since the register chains are of the same length.

57. Can I use 1020A files to program a 1020B device?

Ans. Yes, the 1020B is compatible to the 1020A, but the timing will be different because the 1020B device technology is faster. Actel strongly recommends that you rerun all timing analyses after making the compatible die change.

58. How do I make a device or package change?

Ans. Whenever you make a device or package change to an existing device, other components of the design database need to be regenerated. Exactly what needs to be regenerated depends on what type of change you make. To make the actual changes, follow the appropriate procedures listed in the GURU document located at:

http://www.actel.com/apps/guru/feb00/hw1628.html

59. What is the silicon signature?

Ans. A silicon signature is a 1-5 digit hexadecimal number that can optionally be programmed into an Actel device. The silicon signature is assigned by you during the Fuse Gneration function in Designer. This feature is provided so you can program an individual identification code into your devices. After programming, the silicon signature can be read from the device by executing Blankcheck within the Window's programming software or by executing **Device** > **Actel_Chksum** in the SCULPT software.

60. What is PINCHECKSUM in the .afm file?

Ans. The PINCHECKSUM variable in the .afm file is the package-pin checksum. This checksum always has two values, as shown in the following line:

; VAR PINCHECKSUM 5e7dbf37_c9cf9fee

The first value (5e7dbf37) represents the package type used (for example, 84PLCC vs. 84CQFP). The second value refers to the mapping between design I/Os and their pin assignments.

61. How do I verify that a device has been programmed?

Ans. You can verify that an Actel FPGA has been programmed by placing it in any supported programmer and running a blank check/Actel checksum. To perform a blank check/Actel checksum, use the method described in the following GURU document:

http://www.actel.com/apps/guru/jan00/hw1629.html

62. How do I determine the status of the Actel security fuse?

Ans. How you verify the status of the security fuses in an Actel device depends on the type of programmer you have. Check the following GURU document for information corresponding to your programming configuration.

http://www.actel.com/apps/guru/jan00/rp238.html

63. What is the fuse checksum?

Ans. The fuse checksum is a four digit hexadecimal number programmed into all Actel devices at the end of the programming sequence. This information can be used to match a programmed device to its programming (.afm) file. The fuse checksum is calculated from the fuses in the .afm file and stored in the device. This number will be unique for each fuse map. This number can also change when the target die is changed, even if no change is made to the layout of the device. The checksum is the last information programmed to the device, which is the best way to ensure that all the information has been programmed successfully.

64. What causes the FUSCHECKSUM to change?

Ans. To uniquely identify a given design, Actel created a FUSCHECKSUM in the .afm file. Any design modification that causes a change in the fuse map (that is, the list of fuses to be programmed) will cause a related change in the FUSCHECKSUM. However, there are situations when the FUSCHECKSUM changes, even though no modifications were made to the design (see Situation One and Two below). These changes apply to all devices.

Situation One

There were detailed router changes between the R2-1998 and R1-1999 versions of Actel's Designer software, which could result in different FUSCHECKSUMs from the same, unchanged .adb file. In this case, it is important to remember that the timing is the same since only the software version changed and not the design's placement and routing.

Situation Two

Between R1-1999 and R2-1999, all the unused freeway tie-offs were interchanged between V_{CC} and GND. As a result, there are guaranteed differences in the FUSCHECKSUMs for .afm files that are based on the same .adb file, but generated by the two different software versions. In this case, it is important to remember that the timing is the same since only the software version changed and not the design's placement and routing.

Note: FUSCHECKSUM will be same for conversions between R2-1998 and R3-1998 and for conversions between R2-1999 and R1-2000.

65. What is the difference between Array, Security, Probe, and Program fuse types?

Ans. When you program an Actel FPGA with either the APSW software and an Activator or SCULPT software and a Silicon Sculptor, you have the option to select the fuse type. Depending on the device family you are using, you will be given the options as shown below:

Table 2: Fuse Types

Fuse Types For All Actel Anti fuse Devices Except ACT 1 and 40MX	Fuse Types For ACT 1 and 40MX Devices
Array	Array
Security	Probe
	Program

The differences between these fuse types are as follows:

- Array Fuses: Used to implement your design on the FPGA
- Security Fuse: Used to disable ActionProbe, Silicon Explorer, and ALS Debugger capabilities
- Probe Fuse: Used to disable ActionProbe, Silicon Explorer, and ALS Debugger capabilities (ACT 1 and 40MX only).
- Program Fuse: Prevents additional data from being programmed into the device (ACT 1 and 40MX only)
- For more information, see the Activator and APS Programming System - Installation and User's Guide at:

http://www.actel.com/documents/ActivatorUG.pdf

66. Will parts programmed with the Silicon Sculptor have the same Checksum as devices programmed on the Activator?

Ans. Yes.

67. What is the probability of getting a correct checksum but an incorrect program fuse?

Ans. Each fuse is individually verified during programming and additional programming verification tests are performed before the checksum is programmed, as described above. Programming occurs in this order to ensure that the array fuses are programmed correctly. All units that pass programming are guaranteed to function properly.

68. How can antifuse resistance be determined? Is it possible that fuse resistance could be great enough to cause a delay greater than the worst case simulated delay?

Ans. Antifuse resistance cannot be directly determined on a programmed unit. However, worst-case timing is guaranteed for programmed parts. During programming, the current sensed through each fuse is recorded in the .avi/.txt file each time you program a RH/RT device (prior to RTSX-S).

69. Concerning the programming file .afm, is there a way of incrementing the silicon signature without re-doing the place-and-route?

Ans. There is no way of incrementing the silicon signature without regenerating the .afm file. However, it is not necessary to run place-and-route again and again.

70. Can I modify the header line from "VAR SIG xxxxx" to "VAR SIG yyyyy" in the .afm file to change the silicon signature?

Is the file going to be corrupted?

Is the checksum going to change?

Are there any other side effects?

Ans. The entry in the .afm "VAR SIG xxxx" is simply a comment in the file. Modifying this entry does not affect what gets programmed into the FPGA. The programmer uses this value to compare what is programmed in the part. Changing this value will result in an error when reading the silicon signature back since the programmer is comparing the value in the "VAR SIG xxxx" and what is programmed in the part, which is not altered when you modify "VAR SIG xxxx". To change the silicon signature, you need to change the silicon signature fuses that get programmed in the .afm. The only way to do this, with the

.afm, is to regenerate it from Designer. In any case, you will need a separate .afm for each unique silicon signature.

71. Why does the size of the .adb file change during programming?

Ans. To program an Actel device using Actel's Windows programming software (from Designer v3.0 or later), you can use either the .adb or the .afm file. The file that is actually used during programming is the .afm file, which you can create manually by clicking the **Fuse** button in the Designer flow chart. However, if you skip this step, you can open the .adb file directly and the programming software will internally create the .afm file and add it to the .adb database file. This means that the first time you use this database to program a device; the .adb file size and timestamp will change. If you reuse the same database for subsequent programming, the .adb file will not change size.

Keep in mind that when you program with the .adb file, the auto-generated .afm file is NOT exported to your project directory as a separate file. The only way to export the .afm file (which you need to do if you are programming with Silicon Sculptor) is to click the **Fuse** button in the Designer flow chart.

72. What is the Actel recommended RT/RH programming flow?

Ans. The Actel recommended programming flow for a RT/RH device is as follows:

1. Test the Activator/Silicon Sculptor.
2. Program a commercially equivalent part.
3. Program a RT/RH device.
4. Save the .avi/.txt files (where required).

73. Can I use a .dio file to program with Silicon Sculptor?

Ans. Yes. You can use a Data I/O (.dio) file format to program some Actel devices with Silicon Sculptor. To do so, simply load the .dio file using the **Load** > **Buffer** command and program as usual. Actel recommends you use the .afm file format to program the devices, since Actel does not have control over the Data I/O programming algorithm and does not test it.

74. Are all the antifuses checked by Activator?

Ans. Every fuse being programmed is checked during the programming sequence. Programming pulses are applied across each fuse individually until current is sensed through the fuse. Once current is sensed, additional "soak" pulses are applied to ensure the fuse is programmed. After soak pulses are applied, the programming voltage is lowered and the current is sensed through the fuse again. This verifies that the sensed current is through the programmed fuse and not caused by leakage in the device (check six test). Each fuse is checked individually as the array is programmed. After all array fuses are programmed, a series of additional "net shorts" tests are performed to verify that no additional fuses have been programmed. Checksum fuses are programmed after the net shorts tests are performed.

VIII. Device

VIII.1. RH/ RT/ Military Devices

75. Is there a need for dynamic or static burn-in after programming?

Ans. There is no need for additional burn-in after the units have been programmed. Static and dynamic burn-in are included in the manufacturing flow for all RH/RT devices.

76. Can 172 CQFP sockets withstand military temperatures (-55°C to +125°C)?

Ans. The 172-CQFP socket used by Actel for military temperature testing is a custom socket made by Yamaichi (part number IC51-196-1952). The socket operates in the military temperature range (-55°C to +125°C).

77. Are there statistics for parts failing after burn-in?

Ans. Since units are tested at the fabs, Actel does not have detailed information on units that fail electrical tests after burn-in. However, we do receive the test summaries and travelers, so we know the number of failures is very small (the test flow includes PDA calculations that must be met in order for the lot to ship). As for test failure modes after burn-in, that data belongs to the fabs.

78. What is Expected Programming Failure for RH/RP/RT devices?

Ans. Refer to Table 3 for more information.

Table 3: Maximum Allowed Programming Failures for RH/RP/RT devices

Sample Size	Max Number of Failures
10	3
20	4
50	6
100	10

Note: Programming yield should normally be over 95%. These sample sizes allow a larger percentage due to statistical fluctuations attributable to the small quantities. If you begin to see high programming failures, stop programming and contact your local Actel representative or the Technical Support hotline at 1-800-262-1060.

79. Does Actel recommend programming a commercial part before programming an RH/RT part?

Ans. Before programming a RadHard or RadTolerant device, Actel recommends that you program a commercially equivalent device to ensure the proper setup of the hardware and software. After you have successfully programmed a commercial device, you can program your RadHard or RadTolerant device.

VIII.2. Commercial/Industrial

80. What is the expected programming failure rate for Industrial/Commercial devices?

Ans. Commercial devices typically exhibit a 1-2% programming failure rate. If programming failures exceed the guidelines listed in the Table 4, contact your local sales representative or the Actel Technical Support at 1-800-262-1060.

Table 4: Failure Rate for Industrial/ Commercial Devices

Sample Size	Max. Number of Failures
13	3
31	5
63	8
100	10

Note: Programming yield should normally be over 95%. These sample sizes allow a larger percentage due to statistical fluctuations attributable to the small quantities. If you begin to see high programming failures, stop programming and contact your local Actel representative or the Technical Support hotline at 1-800-262-1060.

81. What is the expected Failure rate for–F devices?

Ans. –F material fallout may be higher than standard parts. 0 to 15% fallout of –F devices can be returned for credit or replacement. If you begin to see high programming failures, stop programming and contact your local Actel representative or the Technical Support hotline at 1-800-262-1060.

VIII.3. General

82. Where can I find the lot number and date code on Actel FPGAs?

Ans. To trace a device's lot history from qualification test records, Actel must have the lot number of the device under investigation. The lot number allows Actel to identify the silicon ingot and wafer from which the device was fabricated. For most Actel FPGAs, the lot number is printed on the bottom of the package and the date code is on the top, although there are exceptions. In either case, the lot number is easy to identify given the following example:

Lot Number: 2ACT312381

Date Code: 9919

The date code indicates that the device is fabricated in the 19th week of 1999, and the wafer is from lot number 2ACT312381

83. Are electrical characteristics of the device guaranteed after programming? Is it necessary to perform functional tests on the programmed units?

Ans. The electrical characteristics outlined in the Actel device datasheet are guaranteed for all devices that pass programming. Additionally, correct functional behavior is guaranteed for all devices that pass programming.

84. Can I program the antifuse devices on board?

Ans. No. Actel does not recommend this and will not support it.

For more information, visit our website at **http://www.actel.com**

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